

## SPECIFICATION

APPARATUS AND METHOD FOR FEEDING WATER,  
AND WASHER PROVIDED THEREWITH

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## Technical Field

[0001] The present invention relates to an apparatus and a method for feeding water which, when water is fed to a target (for example, laundry) to be fed with water, permit a substance (for example, the silver ion or a sustained-release agent), dissolved in the water to exert the effect thereof more easily. The present invention also relates to a washer incorporating such an apparatus for feeding water.

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## Background Art

[0002] When laundry is washed in a washer, it is common to add a treatment substance to the water (in particular the water for rinsing) used. Common examples of such treatment substances are softening agents and starching agents. In addition to these, there has recently been a growing demand for treatment for making laundry antimicrobial.

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[0003] From a hygienic perspective, it is desirable to hang and dry laundry in the sun. In recent years, however, as more women go to work and more families become nuclear, there have been an increasing number of households where no one is present in the house during the daytime. In such a household, there is no choice but to hang and dry laundry indoors. Even in a household where someone is present during the

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discuss problems experienced therewith. Such problems are experienced, however, not only with washers but water feeding apparatuses in general that exploit the effect peculiar to a substance that is initially dissolved in water, but then crystallizes as the water dries up, and then exerts the effect thereof when dissolved in water again.

5 [0016] The present invention is devised to solve the problems mentioned above. Accordingly, it is an object of the present invention to provide an apparatus and a method for feeding water and a washer incorporating such an apparatus which permit easier exertion of the effect peculiar to a substance that is initially dissolved in water, but then crystallizes as the water dries up, and then exerts the effect thereof when  
10 dissolved in water again, and which permit this effect to be obtained surely.

#### **Means for Solving the Problem**

[0017] (1) According to the present invention, a water feeding apparatus for feeding water to a target to be fed with water is provided with: an adder for adding a treatment  
15 substance to the water; and a shower emitter for spraying, in the form of a shower, the water fed thereto via the adder onto the target. Here, the adder is an ion eluter that elutes an antimicrobial and/or antifungal ion as the treatment substance and that adds the ion to the water passing therethrough.

[0018] Liquid droplets in the form of a shower have a larger surface area than the  
20 same amount of water, and thus make contact with air over a larger area. Accordingly, when shower water is sprayed onto the target, the water attached to the target dries more easily.

[0019] As a result, the treatment substance dissolved in the water precipitates more quickly, making it possible to form crystals with smaller particles (i.e., with larger

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surface areas) and with more lattice defects). Since the dissolution of crystals occurs at lattice defects including the surfaces of the crystals, the smaller the particles of

[0023] The adder is an ion eluter that elutes an antimicrobial and/or antifungal ion as the treatment substance and that adds the ion to the water passing therethrough.

[0024] By using an ion eluter as the adder, it is possible to spray water containing an antimicrobial and/or antifungal ion serving as the treatment substance from the shower emitter onto the target. By using as the ion, for example, the silver ion or the zinc ion, it is possible to obtain on the target the antimicrobial effect peculiar to those ions. By using as the ion, for example, the copper ion, it is possible to exert on the target the antifungal effect peculiar to that ion.

[0025] By spraying, in the form of a shower, liquid droplets containing the silver or zinc ion having an antimicrobial effect or the copper ion having an antifungal effect into a space, it is possible to capture germs and mold floating in the space into liquid droplets and then deactivate them with those ions. Here, "deactivate" denotes exerting disinfecting, antimicrobial, sterilizing, decomposing, eliminating, and other effects. By spraying liquid droplets containing such an ion onto food, it is possible to prevent the rotting of the food and keep the food fresh.

[0026] As well as the silver, copper, and zinc ions, the nickel, palladium, platinum, rhodium, ruthenium, and other ions have an effect of retarding the aging and deterioration in freshness of plants caused by ethylene. Thus, by spraying liquid droplets containing such an ion on vegetables, fruits, and cut flowers, it is possible to keep them fresh.

(2) In the water feeding apparatus of the invention, the shower emitter may be so constructed as to repeatedly spray the shower onto the target. For example, in a case where the antibacterial ion is the silver ion, even if the amount of silver attached to the target (for example, laundry or cloth) is insufficient with a single session of

treatment, by repeating the shower-spraying of silver ion water, it is possible to increase the amount of silver attached.

[0027] (3) In the water feeding apparatus of the invention, the ion eluter may include an electrode from which a metallic ion is eluted and an outflow port through which the  
5 water is fed to the shower emitter, with the outflow port located in a position lower

composed of a vibrator that atomizes by vibration the water fed thereto via the adder.

[0032] Where shower emission is used, to obtain small liquid droplets, it is necessary to use small holes (nozzles). Small holes are liable to cause water to stagnate inside the water passage, and may themselves be clogged with precipitate. Small holes are liable to cause water to stagnate also inside the adder, and may thus cause, in particular when the adder is provided with electrodes, precipitate to form and thereby short-circuit between the electrodes. To prevent this, it is necessary, for example, to provide a plurality of outflow ports. When high-concentration silver ion water is used, the small holes themselves may be clogged.

10 [0033] By contrast, where a vibrator is used to atomize water, there is no need to use small holes. This helps avoid the problems mentioned above. Moreover, simply by stopping the feeding of the signal to the vibrator, it is possible to stop atomizing silver ion water. This is convenient when silver ion water is collected in a container so as to be used for other purposes.

15 [0034] According to the present invention, a method of feeding water whereby shower water is sprayed onto a target to be fed with water uses the water feeding apparatus of claim 1.

[0035] By spraying shower water onto the target by the use of the water feeding apparatus of the invention, it is possible to quicken the drying of the liquid droplets attached to the surface of the target, and to make the treatment substance dissolved in the water precipitate and crystallize in a state that permits the treatment substance to be easily eluted when it meets water next time. This makes it easier for the treatment substance to exert the effect (for example, an antimicrobial effect) peculiar thereto that

it exerts when eluted. Thus, it is possible to surely obtain the effect.

[0036] Moreover, the liquid droplets of shower water are small and have large surface areas, and are thus easier to dry. Thus, by spraying shower water onto the target, it is possible, irrespective of the type of the target (i.e., irrespective of whether the target is water-repellent or hydrophobic), to surely make water containing the treatment substance attach to the surface of the target. Thus, it is possible to obtain the above-described effect irrespective of the type of the target.

[0037] (7) According to the present invention, a washer is provided with: the water feeding apparatus of the invention described above; and a laundry tub in which laundry is put as the target to be fed with water.

[0038] In the washer constructed as described above, the water containing the treatment substance from the water feeding apparatus is sprayed, in the form of a shower, onto the laundry put in the laundry tub. In this way, it is possible to quicken the drying of the liquid droplets attached to the surface of the laundry, and make the treatment substance crystallize in a state that permits it to be easily eluted when it meets water next time. This makes it easier for the treatment substance to be eluted when it makes contact with water next time, and thus makes it easier for the treatment substance to exert the effect (for example, a antimicrobial effect) peculiar thereto. Thus, it is possible to surely obtain the effect on the laundry.

20 [0039] (8) The washer of the invention may be further provided with controlling means for controlling the addition of the antimicrobial and/or antifungal ion to the water by the adder in such a way that either first water containing the antimicrobial and/or antifungal ion or second water not containing the antimicrobial and/or antifungal ion is sprayed onto the laundry earlier than is the second water or the first

water, respectively.

[0040] In the construction described above, under the control of the controlling means,



it is possible to effectively clean the tub with a small amount of water. In this way, it is possible to suppress the proliferation of germs and mold inside the laundry tub and on the surface of the agitating member.

[0063] (19) In the washer of the invention, the operation controller may be so  
5 configured as to control the operation of the tub cleaning course in such a way that the tub is cleaned with water containing the metallic ion.

[0064] By cleaning the tub with water containing a metallic ion (for example, the silver ion or the copper ion), it is possible to effectively suppress the proliferation of germs and mold inside the laundry tub and on the surface of the agitating member.

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#### **Advantages of the Invention**

[0065] As described above, according to the present invention, in an apparatus and a method for feeding water and a washer incorporating such an apparatus, liquid droplets having small particles that are easy to dry and that thus permit a treatment  
15 substance to be easily eluted as a result of the dissolution of crystals are generated and sprayed by a shower emitter onto a target to be fed with water. This makes it easy for the treatment substance to exert the effect thereof that it exerts when eluted. Thus, it is possible to surely obtain the effect peculiar to the treatment substance.

[0066] Moreover, even when the target is water-repellant or hydrophobic cloth, by  
20 spraying shower water onto the cloth, it is possible to surely make the treatment substance contained in the shower water attach to the surface of the cloth. Thus, even with a target, such as water-repellant or hydrophobic cloth, that the treatment substance is difficult to penetrate, it is possible to surely obtain the effect of the treatment substance that it exerts when eluted. By using as the ion serving as the

treatment substance, for example, the silver ion or the zinc ion, it is possible to obtain on the target the antimicrobial effect peculiar to those ions. By using as the ion serving as the treatment substance, for example, the copper ion, it is possible to exert on the target the antifungal effect peculiar to the copper ion.

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### **Brief Description of Drawings**

[0067] [Fig. 1] A sectional view showing an outline of the construction of a washer embodying the invention;

10 [Fig. 2] A sectional view schematically showing the construction of the water server unit of the above washer;

[Fig. 3] A flow chart showing the flow of operations performed through an entire washing procedure in the above washer;

[Fig. 4] A flow chart showing the flow of operations performed in the washing process in the above washing procedure;

15 [Fig. 5] A flow chart showing the flow of operations performed in the rinsing process in the above washing procedure;

[Fig. 6] A flow chart showing the flow of operations performed in the spin-drying process in the above washing procedure;

20 [Fig. 7] A perspective view, as seen obliquely from above, of the above washer fitted with a water feeding apparatus embodying the invention;

[Fig. 8] A side view schematically showing an outline of the construction of the above water feeding apparatus;

[Fig. 9] A perspective view schematically showing the exterior appearance and internal construction of the ion elution unit of the above water feeding apparatus;

[Fig. 10] A diagram illustrating an outline of the configuration of the drive circuit of the above ion elution unit;

[Fig. 11] A diagram illustrating the contents of the standard and antimicrobial treatment courses performed by the above washer;

and taken out of a washing tub. The lid 402 is fitted with a supersonic partial washing apparatus 405 (vibrator). Moreover, an unillustrated silver ion elution unit (corresponding to the ion elution unit 100) is provided in the route of a feed pipe 410 leading to the partial washing apparatus 405. Here, water is fed in in such a way that the water makes contact  
5 with a metal horn connected to the supersonic vibrator provided inside the partial washing apparatus 405.

[0276] The silver ion is eluted from the silver ion unit so that silver ion water is fed to the partial washing apparatus 405, and the horn is made to vibrate, with the result that the silver ion water is formed into a mist. When, by using this construction, silver ion water is  
10 attached to a target to be fed with water, an antimicrobial effect was obtained that was similar to that obtained in the washer 1 shown in Fig. 7, i.e., a construction where the silver ion is attached to the target by using a shower.

[0277] When a shower nozzle is used, to make the obtained liquid droplets small, the holes (emission orifices) need to be made small. However, small holes are liable to cause  
15 water to remain in the water feed route. Moreover, precipitates may cause clogging, or cause water to remain inside the ion elution unit. In particular, in a construction where the elution unit is provided with electrodes, precipitates may cause short-circuiting between the electrodes. To avoid this, it is necessary to secure easy drainage, as by providing a plurality of outflow ports. Moreover, when high-concentration silver ion water is used, the holes  
20 themselves may be clogged.

[0278] By contrast, when a mist is produced by the use of a vibrator, it is possible to produce fine liquid droplets without making the holes smaller. This helps avoid the disadvantages mentioned above. Moreover, when the input of a signal to the vibrator is stopped, silver ion water can be fed without being formed into a mist. This is convenient

when silver ion water is collected in a container so as to be used for other purposes.

[0279] Moreover, the washer 401 of this embodiment is of the type that is provided with a metal horn to which water is fed as necessary. However, the washer 401 may be so constructed that, instead of water being fed in as necessary, the horn or the vibrator is dipped  
5 in stored water.

[0280] Alternatively, a fan, air pump, or the like may be used to send or suck air so that a mist containing the silver ion is fed to the target. This makes it possible to exert an antimicrobial or other effect on a target extending in a wide area or located at a remote place.

[0281] The shower emitter does not necessarily have to be mounted on a washer, nor does  
10 the target of shower-spraying necessarily have to be laundry. Specifically, it is possible to spray a shower containing an antimicrobial ion such as the silver, copper, or zinc ion onto, for example, a kitchen sink, chopping board, toy, floor, carpet, bathtub, toilet, or urinal to obtain an antimicrobial effect. It is also possible to spray, in the form of a shower or the like, liquid droplets containing an antimicrobial ion into the air to remove germs present in the air. It is  
15 also possible to spray them onto a pet or plant to prevent odors and diseases ascribable to bacteria.

[0282] By spraying liquid droplets containing an antimicrobial ion onto food, it is possible to prevent the rotting of the food and keep the food fresh. As well as the silver, copper, and zinc ions, the nickel, palladium, platinum, rhodium, ruthenium, and other ions  
20 have an effect of retarding the aging and deterioration in freshness of plants caused by ethylene. Thus, by spraying liquid droplets containing such an ion on vegetables, fruits, and cut flowers, it is possible to keep them fresh.

[0283] (8-3. Treatment Substances)

In this embodiment, used as an example of the treatment substance that is added to

the water that is fed to the adder (ion elution unit 100) is the silver ion. However, the treatment substance actually used is not limited to the silver ion. As the treatment agent, a sustained-release agent may be used. Also in that case, on the same principle as described previously, it is possible to easily exploit the effect peculiar to the sustained-release agent.

5 [0284] (*deleted*)

[0285] Here, a sustained-release agent is a material containing silver which, when brought into contact with water, gradually releases the silver ion. Examples include hardly soluble silver sulfide that dissolves gradually, zeolite containing silver that permits the silver ion to be gradually eluted, water-soluble glass containing the silver ion that permits the silver ion to be  
10 gradually eluted as the glass dissolves.

[0286] In a case where a sustained-release agent is used, it is not possible to control whether or not to effect the releasing (whether or not to effect the elution of silver). Thus, it is preferable to provide a separate water feed route and to use this route only when silver is added. Moreover, in a case where a sustained-release agent is used, it is not possible to

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## CLAIMS

- [1] (Amended) A water feeding apparatus for feeding water to a target to be fed with water, comprising:  
an adder for adding a treatment substance to the water; and  
5 a shower emitter for spraying, in a form of a shower, the water fed thereto via the adder onto the target,  
wherein the adder is an ion eluter that elutes an antimicrobial and/or antifungal ion as the treatment substance and that adds the ion to the water passing therethrough.
- [2] (Amended) The water feeding apparatus of claim 1,  
10 wherein the shower emitter repeatedly sprays the shower onto the target.
- [3] (Amended) The water feeding apparatus of claim 1,  
wherein the ion eluter includes an electrode from which a metallic ion is eluted and an outflow port through which the water is fed to the shower emitter, and  
wherein the outflow port is located in a position lower than a lower end of the  
15 electrode.
- [4] (Amended) The water feeding apparatus of claim 1,  
wherein the ion eluter includes an electrode from which a metallic ion is eluted and an outflow port through which the water is fed to the shower emitter, and  
wherein the outflow port includes a first outflow port that is located in a position  
20 lower than a lower end of the electrode and a second outflow port that is located in a position higher than a higher end of the electrode.
- [5] The water feeding apparatus of claim 1,  
wherein the shower emitter is composed of a vibrator that atomizes by vibration the

water fed thereto via the adder.



- [6] A method of feeding water whereby water in a form of a shower is sprayed onto a target to be fed with water by use of the water feeding apparatus of claim 1.
- [7] A washer comprising:  
the water feeding apparatus of claim 1; and  
5 a laundry tub in which laundry is put as the target to be fed with water.
- [8] (Amended) The washer of claim 7, further comprising:  
controlling means for controlling addition of the antimicrobial and/or antifungal ion to the water by the adder in such a way that either first water containing the antimicrobial and/or antifungal ion or second water not containing the antimicrobial and/or  
10 antifungal ion is sprayed onto the laundry earlier than is the second water or the first water, respectively.
- [9] The washer of claim 8,  
wherein the controlling means performs control such that the shower emitter sprays the first water during at least one of a rinsing process, a spin-drying process, and a  
15 drying process.
- [10] The washer of claim 9,  
wherein the controlling means performs control such that spraying of the first water by the shower emitter is turned on and off repeatedly during a drying process.
- [11] The washer of claim 8,  
20 wherein the controlling means performs control such that the laundry is moved while the first water is being sprayed.
- [12] The washer of claim 8,  
wherein the controlling means performs control such that air is blown onto the laundry while the first water is being sprayed.

- [13] The washer of claim 8,  
wherein the treatment substance is a metallic ion.